

Notes - Composition of Functions

→ Plug one function into another

$$(f \circ g)(x) = f[g(x)]$$

first letter
= outside
function

second letter
= inside
function

⇒ Plug the whole $g(x)$ function
into $f(x)$

$$(g \circ f)(x) = g[f(x)]$$

⇒ Plug the whole $f(x)$ function
into $g(x)$

* Use structure of the outside function

Ex 1: $f(x) = 5x + 2$ $g(x) = -2x$

A. $(f \circ g)(x) = f[g(x)] = f(-2x)$
 $= 5(-2x) + 2$
 $= \boxed{-10x + 2}$

B. $(g \circ f)(x) = g[f(x)]$
 $= -2(5x + 2)$
 $= \boxed{-10x - 4}$

You Do: $f(x) = 4x$

$$g(x) = 2x - 1$$

A. $(f \circ g)(x)$

$$f[g(x)]$$

$$f(2x - 1)$$

$$4(2x - 1)$$

$$= \boxed{8x - 4}$$

B. $(g \circ f)(x)$

$$g[f(x)]$$

$$g(4x)$$

$$2(4x) - 1$$

$$\boxed{8x - 1}$$

Ex 2: $f(x) = 2x^2 - x$

$$g(x) = 3x + 1$$

A. $(g \circ f)(x) = g(f(x))$
 $= g(2x^2 - x)$

$$= 3(2x^2 - x) + 1$$

$$= \boxed{6x^2 - 3x + 1}$$

B. $(f \circ g)(x) = f(g(x))$

$$= f(3x + 1)$$

$$= 2(3x + 1)^2 - (3x + 1)$$

$$= 2(3x + 1)(3x + 1) - 3x - 1$$

$$= 2(9x^2 + 6x + 1) - 3x - 1$$

$$= 18x^2 + 12x + 2 - 3x - 1$$

$$= \boxed{18x^2 + 9x + 1}$$

	$3x + 1$	
$3x$	$9x^2$	$3x$
$+1$	$3x$	1